Physics

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A 4x4 density matrix completely describes the state of a two qubit system. Additionally, we can define the process of a two qubit "black box" by a 16x16 error correlation matrix. However, using experimental data directly often does not correspond to a physically legitimate matrix due to experimental noise. We have used numerical optimization techniques to make tomographic reconstructions of these matrices, which are related to the experimental data by a maximum likelihood function. We have developed and used various mathematical constructs as well as streamlined implementation procedures in Fortran. The errors of these matrices have been calculated and are pending further investigation. Quantum tomography is of fundamental importance for prototyping a few-qubit device. This work will be important for the potential design of a practical quantum computer.

LA-UR-04-6222